

IN THE CLAIMS

Cancel Claims 1-20 without prejudice or disclaimer of the subject matter therein.

Add the following new claims.

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27. A hole forming system with multiple spindles per spindle station, comprising:

a base table;  
a work piece table for supporting work pieces under process;  
a first drive system for moving the work piece table along a Y axis in relation to the base table;  
a plurality of spindle stations;  
a first ganged set of spindles, each for holding a hole forming tool, comprising a first spindle at each said spindle station;  
a second ganged set of spindles, comprising a second spindle at each said spindle station;  
a first spindle linear drive system for commonly driving said first set of spindles along an X axis which is orthogonal to said Y axis;  
a second spindle linear drive system for commonly driving said second set of spindles along the X axis; and  
a Z axis drive system for driving said spindles along a Z axis which is orthogonal to said X and Y axis.

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28. The system of Claim 27 further comprising a controller for controlling said Y axis, X axis and Z axis drive systems to conduct hole forming operations on a plurality of work pieces located at respective ones of said spindle stations, such that a first spindle of said first set and a first spindle of said second set is operated to conduct hole forming operations simultaneously on a single work piece.

29. The system of Claim 27 wherein said first set of spindles and said second set of spindles are arranged on a common plane which is orthogonal to said work piece table.

30. The system of Claim 27 wherein spindles of said first set are interleaved along the X axis with spindles of the second set.

31. The system of Claim 27 wherein said first spindle linear drive includes:

a linear bearing for supporting a first set of spindle slides for motion along the X axis, each slide supporting a corresponding one of said first spindle set;

a first bar structure rigidly attached to each slide of said first slide set to gang together said first set of slides in a spaced relationship on said linear bearing for motion as a first ganged set along the linear bearing; and

a first linear force applying structure for moving the first ganged set along the X axis.

32. The system of Claim 31 wherein said first linear force applying structure includes a servo motor coupled to a leadscrew, and a leadscrew nut threaded onto the leadscrew and secured to said first ganged set.

33. The system of Claim 32 wherein said leadscrew nut is secured to one slide of said first set of slides.

34. The system of Claim 31 wherein said first linear force applying structure includes a linear motor drive system including a set of stationary permanent magnets extending along the X axis and a coil attached to said first ganged set.

35. The system of Claim 31 wherein said linear bearing further supports a second set of spindle slides for motion along the X axis, each slide of said second slide set supporting a corresponding spindle of said second spindle set, and wherein second spindle linear drive further includes:

a second bar structure rigidly attached to each slide of said second slide set to gang together said second set of slides in a spaced relationship on said linear bearing for motion as a ganged set along the linear bearing; and

a second linear force applying structure for moving the second ganged set along the X axis.

36. The system of Claim 31 wherein said linear bearing includes first and second linear guiding rails secured to an overhead beam supported over said work piece table, and, for each slide, a plurality of bearing slide members each attached to said slide and constrained for sliding movement along one of said linear guiding rails.

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37. A hole forming system, comprising:

a base table;

a work piece table for supporting work pieces under process;

a first drive system for moving the work piece table along a Y axis in relation to the base table;

a plurality of spindle stations;

a ganged set of a plurality of spindles, each spindle for holding a hole forming tool, each spindle bearing mounted on a common linear bearing for linear movement along an X axis which is transverse to said Y axis, the spindles of said ganged set commonly connected together;

a computer-controllable spindle linear drive system for commonly driving said ganged set of a plurality of spindles along said X axis; and

Z axis drive system for individually driving said spindles along a Z axis which is transverse to said X and Y axis.

38. The system of Claim 37 further comprising a controller for controlling said spindle linear drive system and said Z axis drive system to conduct hole forming operations on a plurality of work pieces located at respective ones of said spindle stations.

39. The system of Claim 37 further comprising adjustable mounting structure for mounting each spindle to said bearing system to align each spindle in the Z and X axis.

40. The system of Claim 37, wherein said ganged set of a plurality of spindles comprises four spindles.

41. A hole forming system, comprising:

- a base table;
- a work piece table for supporting work pieces under process;
- a Y axis drive system for moving the work piece table along a Y axis in relation to the base table;
- a plurality of spindle stations;
- a ganged set of a plurality of spindles, each spindle for holding a hole forming tool, comprising a spindle at each said spindle station, said plurality of spindles commonly connected together for common movement along an X axis which is orthogonal to said Y axis;
- a spindle linear drive system for commonly driving said ganged set of spindles along said X axis; and
- a Z axis drive system for driving said spindles along a Z axis which is orthogonal to said X and Y axis.

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42. The system of Claim 41 further comprising a controller for controlling said Y axis drive system, said spindle linear drive system, and said Z axis drive systems to conduct hole forming operations on a plurality of work pieces located at respective ones of said spindle stations.

43. The system of Claim 41 wherein said first set of spindles and said second set of spindles are arranged on a common plane which is orthogonal to said work piece table.

44. The system of Claim 41 wherein said spindle linear drive system includes:

- a set of spindle slides for motion along the X axis, each slide supporting a corresponding one of said plurality of spindles;
- a linear bearing for supporting said set of spindle slides for motion along the X axis;
- a bar structure rigidly attached to each slide to gang together said first set of slides in a spaced relationship on said linear bearing for motion as said ganged set along the linear bearing; and
- a linear force applying structure for moving the ganged set of spindles along the X axis.